

REMARKS

This is intended as a full and complete response to the Office Action dated May 12, 2010, having a shortened statutory period for response with a one-month extension set to expire on September 13, 2010. Please reconsider the claims pending in the application for reasons discussed below.

Claims 1-55 are pending in the application and remain pending following entry of this response. Claims 1, 13, 21, 34, and 47 have been amended. Applicants submit that the amendments do not introduce new matter.

Further, Applicants are not conceding in this application that those amended claims are not patentable over the art cited by the Examiner, as the present claim amendments are only for facilitating expeditious prosecution of the claimed subject matter. Applicants respectfully reserve the right to pursue these pre-amended claims and other claims in one or more continuations and/or divisional patent applications.

Claim Rejections – 35 USC § 101

Claims 1-12, 17-20, 21-33, 39-41, 42-46, 50-52 are rejected under 35 U.S.C. 101 because the Examiner contends the claimed invention is directed to non-statutory subject matter. Applicants respectfully traverse this rejection.

“A claimed process is surely patent-eligible under § 101 if: (1) it is tied to a particular machine or apparatus, or (2) it transforms a particular article into a different state or thing. *See Benson*, 409 U.S. at 70, 93 S.Ct. 253 (‘Transformation and reduction of an article ‘to a different state or thing’ is the clue to the patentability of a process claim that does not include particular machines.’).” *In re Bilski*, 545 F.3d 943 (2008). “A claimed invention is directed to a practical application of a 35 U.S.C. 101 judicial exception when it: (A) ‘transforms’ an article or physical object to a different state or thing; or (B) otherwise produces a useful, concrete and tangible result...” *See* MPEP § 2106.

Claim 1 has been amended to recite “transmitting at least one transmit symbol based on the at least one steering matrix.” Similarly, claim 21 has been amended to recite “transmitting the at least one spatially processed data symbol.” Support for these amendments may be found in at least paragraphs [0044] and [0048] of the present application. Applicants respectfully submit that forming a steering matrix and then transmitting at least one symbol based on the steering matrix involves sufficient transformation (e.g., transforming digital symbols, such as data or pilot symbols, into radio frequency electrical signals) to qualify as patent-eligible subject matter.

Accordingly, Applicants submit that claims 1 and 21, as well as claims dependent therefrom, are allowable and respectfully request withdrawal of this rejection.

Claim 42 recites “a *receiving entity*” and “obtaining...R sequences of received symbols via R receive *antennas*” (emphasis added). Therefore, the process of claim 42 is tied to a particular machine or apparatus (i.e., a receiving entity having receive antennas) and, thus, qualifies as patent-eligible subject matter.

Accordingly, Applicants submit that claim 42, as well as claims dependent therefrom, are allowable and respectfully request withdrawal of this rejection.

With respect to claims 17, 39, and 50, the Examiner contends that the components of “generating steering matrices” can be performed in software, and that software is a judicial exception to 35 U.S.C. 101 (page 2 of the current Office Action). However, the various means recited in claims 17, 39, and 50 may comprise, for example, “a processor (e.g., controller 340, 380x, or 380y)” and/or a memory unit (e.g., memory unit 342, 382x, or 382y in FIG. 3)” (paragraph [0075] of the present application). A processor unquestionably qualifies as a patent-eligible apparatus.

Accordingly, Applicants submit that claims 17, 39, and 50, as well as claims dependent therefrom, are allowable and respectfully request withdrawal of this rejection.

Claim Rejections – 35 USC § 112

Claims 13, 34, 47 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 14-16, 35-38, 48-49 are rejected based on the respective independent claim.

Applicants have amended claims 13, 34, and 47 to particularly point out and distinctly claim the subject matter which Applicants regard as the invention, thereby obviating this rejection. Withdrawal of this rejection is respectfully requested.

Claim Rejections – 35 USC § 103

Claims 1-3, 5-6, 10, 15, 17, 19, 21, 24-25, 32-33, 35-36, 40-42, 45-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Kishigami et al* (US Patent No. 6642888, hereinafter “*Kishigami*”) in view of *Adams* (US Patent No. 6218985). Applicants respectfully traverse this rejection.

The Examiner bears the initial burden of establishing a prima facie case of obviousness. See MPEP § 2141. Establishing a prima facie case of obviousness begins with first resolving the factual inquiries of *Graham v. John Deere Co.*, 383 U.S. 1 (1966). The factual inquiries are as follows:

- (A) determining the scope and content of the prior art;
- (B) ascertaining the differences between the claimed invention and the prior art;
- (C) resolving the level of ordinary skill in the art; and
- (D) considering any objective indicia of nonobviousness.

Once the *Graham* factual inquiries are resolved, the Examiner must determine whether the claimed invention would have been obvious to one of ordinary skill in the art.

Respectfully, Applicants submit that the Examiner has not properly characterized the teachings of the references and/or the claims at issue. Accordingly, a prima facie case of obviousness has not been established.

For example, the Examiner concedes that *Kishigami* “does not clearly show selecting at least different scalar values,” but relies on *Adams* as teaching this element (page 5 of the current Office Action). Despite the Examiner’s contentions, however, *Kishigami* in view of *Adams* does not teach, show, or suggest "selecting at least one different combination of scalars, each combination including at least one scalar for at least one row of the base matrix, one scalar per row, each scalar being a real or complex value" and "forming at least one steering matrix by multiplying a base matrix with the at least one different combination of scalars, wherein one steering matrix is formed by each combination of scalars" as recited in claim 1.

In the current Office Action, the Examiner refers to Equation 12 of *Kishigami* and corresponding description as teaching "selecting at least one different combination of scalars, each combination including at least one scalar for at least one row of the base matrix, one scalar per row, and each scalar being a real or complex value" (page 4). The Examiner refers to element $a(\theta)$ in Equation 12 as a “scalar vector” and states that col. 4, lines 50-51 discloses that "the scalar vector contains scalar values selected for a specific array antenna." *Id.* However, col. 4, lines 50-51 only teach that " $\|x\|$ is the norm of vector x , and $a(\theta)$ is a normalized steering vector of the array antenna." Applicants respectfully submit that the Examiner has made up the term “scalar vector” and that there is no such teaching in *Kishigami*. *Kishigami* teaches only that “ $a(\theta)$ is a complex response (hereinafter called a steering vector) of the array antenna as a function of azimuth θ ” (col. 2 lines 6-8). Therefore, *Kishigami* is silent with respect to "selecting at least one different combination of scalars” as recited in claim 1. In fact, the only "selecting" described in *Kishigami* is with reference to selecting complex digital signals or selecting antennas. Independent claims 13, 17, and 53 recite similar limitations not taught by the art of record.

As another example, Equation 12 of *Kishigami* does not teach “each combination including at least one scalar for at least one row of the base matrix, *one scalar per row*” as recited in claim 1 (emphasis added). Equation 12 teaches that a unitary matrix Q_M may be multiplied with a steering vector $a(\theta)$ to produce real vector $b(\theta)$. Applicants respectfully submit that with matrix multiplication (including multiplying a matrix with a vector), there cannot possibly be one scalar per row as required by claim 1. According to matrix multiplication, the element i,j of the matrix

product of matrices $[A]$ and $[B]$ will be the dot product of row i of $[A]$ and column j of $[B]$. For example, if row i of $[A]$ is $[1\ 2\ 3\ 4]$ in a 4×4 matrix and column j of $[B]$ is $[a\ b\ c\ d]$, then element i,j of $[A][B]$ is equal to $(1)(a) + (2)(b) + (3)(c) + (4)(d)$. The Examiner's attention is directed to any textbook on matrix multiplication and/or "Matrix Multiplication," http://en.wikipedia.org/wiki/Matrix_multiplication, March 31, 2010. Therefore, rather than "one scalar per row" of the base matrix as required by claim 1, Equation 12 of *Kishigami* teaches more than one scalar per row of unitary matrix Q_M since $a(\theta)$ has M elements, and $M > 1$ (col. 4 lines 1-51). In the case of a 4-element vector $a(\theta)$ multiplied with a 4×4 matrix Q_M , for example, this would involve 4 scalars per row of the matrix, rather than one scalar per row of the matrix as required by claim 1. Independent claims 13, 17, and 53 recite similar limitations not taught by the art of record.

The Examiner's attention is directed to paragraphs [0024] and [0025] of the present application for an example of "selecting at least one different combination of scalars, each combination including at least one scalar for at least one row of the base matrix, one scalar per row" and then multiplying a single selected scalar per row of the base matrix to form the steering matrix. For example, "for an $N \times N$ base matrix, each of rows 2 through N of the base matrix may be independently multiplied with *one* of K different possible scalars" (paragraph [0026] lines 1-2, emphasis added).

Furthermore, Applicants respectfully submit that a person having ordinary skill in the art would not consider a vector as a "combination of scalars" as recited in independent claims 1, 13, 17, 21, 34, 39, 42, 47, 50, and 53-55. A vector can be defined as "a one-dimensional array" (*American Heritage Dictionary, 2nd College Edition*. Boston: Houghton Mifflin Company, 1991). In contrast, a combination of scalars is not an array, but is simply a set of real or complex values (paragraph [0034] of the present application). For example, the combination of scalars may include "any one of K possible scalars" where " K may be four, and the four possible scalars may be $+1$, -1 , $+j$, and $-j$." *Id.* Therefore, steering vector $a(\theta)$ does not teach a combination of scalars.

Adams fails to overcome the deficiencies in *Kishigami*. Rather, *Adams* teaches only that the "desired beam pattern $F(\phi)$ of the antenna array may be selected for M values of ϕ ," where the

“desired steered beam pattern $F(\varphi_m)$, i.e., the desired electric field of the antenna array at azimuth m , has a dimension of $1 \times M$ ” (col. 3 lines 33-38). In other words, *Adams* teaches selecting a vector having a dimension of $1 \times M$, not a combination of scalars. Furthermore, as described above with respect to *Kishigami*, such a vector in *Adams* could not possibly involve “at least one scalar for at least one row of the base matrix, *one scalar per row*” as recited in claim 1.

For at least these reasons, *Kishigami* in view of *Adams* fails to teach, show, or suggest independent claims 1, 13, 17, 21, 34, 39, 42, 47, 50, and 53-55. Accordingly, Applicants submit that these independent claims, as well as claims dependent therefrom, are allowable over the art of record and respectfully request withdrawal of this rejection.

Claims 12 and 53-55 are rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over *Kishigami* in view of *Adams*. Claims 4 and 28 are rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over *Kishigami* in view of *Adams*, and further in view of Craw (“The Fourier Matrix,” December 2003 <http://www.maths.abdn.ac.uk/~igc/tch/eg1006/notes/node123.html>). Claims 11 and 13 are rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over *Kishigami* in view of *Adams*. Claims 22-23 are rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over *Kishigami* in view of *Adams*, and further in view of *Khatri* (U.S. Patent No. 7,020,490). Claims 42 and 45-52 are rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over *Kishigami* in view of *Adams*, and further in view of *Khayrallah et al.* (U.S. Patent No. 6,711,124, hereinafter, “*Khayrallah*”). Claims 43-44 are rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over *Kishigami* in view of *Adams*, and further in view of *Khayrallah* in view of *Khatri*. Applicants respectfully traverse these rejections.

Applicants respectfully submit that each of these claims includes limitations discussed above, which are not taught in *Kishigami* in view of *Adams*. Applicants further submit that none of these additional references overcomes the shortcomings in the teachings of *Kishigami* in view of *Adams* discussed above. Accordingly, Applicants submit these claims are also allowable over the art of record and request withdrawal of these rejections.

Therefore, the claims are believed to be allowable over the art of record, and allowance of the claims is respectfully requested.

Conclusion

Having addressed all issues set out in the Office Action, Applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed.

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Respectfully submitted, and
S-signed pursuant to 37 C.F.R. 1.4,

By: /MJDeHaemerJr#39164/
Michael DeHaemer
Registration No. 39,164

QUALCOMM Incorporated
Attn: Patent Department
5775 Morehouse Drive
San Diego, California 92121-1714
Telephone: (858) 658-5787
Facsimile: (858) 658-2502